

# INTERNATIONAL COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Australian Patent Office  
P.O. Box 200  
Woden, ACT 2606  
AUSTRALIE

in its capacity as elected Office

Date of mailing: 22 July 1999 (22.07.99)	
International application No.: PCT/PL98/00052	Applicant's or agent's file reference:
International filing date: 31 December 1998 (31.12.98)	Priority date: 19 January 1998 (19.01.98)
Applicant: \$m(C)AGODZINSKI, Marek et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:  
02 June 1999 (02.06.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer:</p> <p>J. Zahra</p> <p>Telephone No.: (41-22) 338.83.38</p>
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## INTERNET COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

United States Patent and Trademark  
Office  
(Box PCT)  
Crystal Plaza 2  
Washington, DC 20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing:

22 July 1999 (22.07.99)

International application No.:

PCT/PL98/00052

Applicant's or agent's file reference:

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The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.  PCT/PL 98/ 00052	International filing date (day/month/year)  31/12/1998	(Earliest) Priority Date (day/month/year)  19/01/1998
Applicant  LAGODZINSKI, Marek et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1

None of the figures.

## INTERNATIONAL SEARCH REPORT

National Application No

T/PL 98/00052

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 B25C1/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 B25C F16F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 331 546 A (BRUNELLE) 18 July 1967 cited in the application see column 2, line 29-35; figures 1-3 ---	1,2,4
A	EP 0 732 178 A (ADOLF WÜRTH) 18 September 1996 see column 7, line 28-41 see column 10, line 33-45; figures 3,10 ---	1,7
Y	DE 31 51 771 A (METZELER KAUTSCHUK) 14 July 1983 see claims 1,7; figures 1-3 ---	1,2,4
A	DE 18 11 684 U (PORSCHE) see claim 1; figure 1 ---	2,3,5,7
A	DE 11 03 775 B (PAUL HENSS) see column 1, line 1-8; figures 1,2 ---	3,5
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## ° Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

9 June 1999

Date of mailing of the international search report

21/06/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Matzdorf, U

## INTERNATIONAL SEARCH REPORT

International Application No

/PL 98/00052

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 559 862 A (COMPAGNIE DES PRODUITS INDUSTRIELS DE L'OUEST) 23 August 1985 see abstract; figures 2,3 -----	2,3

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

/PL 98/00052

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3331546	A	18-07-1967	BE 681919 A	01-12-1966
			DE 1603918 A	28-01-1971
			FR 1481590 A	18-08-1967
			GB 1142869 A	
			NL 6607554 A	02-12-1966
			US 3368730 A	13-02-1968
EP 732178	A	18-09-1996	DE 19509763 A	19-09-1996
DE 3151771	A	14-07-1983	NONE	
DE 1811684	U		NONE	
DE 1103775	B		NONE	
FR 2559862	A	23-08-1985	NONE	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

16

Applicant's or agent's file reference ....		<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/PL98/00052	International filing date (day/month/year) 31/12/1998	Priority date (day/month/year) 19/01/1998	
International Patent Classification (IPC) or national classification and IPC B25C1/14			
Applicant LAGODZINSKI, Marek et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  02/06/1999	Date of completion of this report  12. 11. 99
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Korn, K-C  Telephone No. +49 89 2399 2342  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/PL98/00052

## I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

### Description, pages:

1-7 as originally filed

### Claims, No.:

1-7 as originally filed

### Drawings, sheets:

1/4-4/4 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/PL98/00052

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 1,2-7
	No:	Claims
Inventive step (IS)	Yes:	Claims 1,2-7
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-7
	No:	Claims

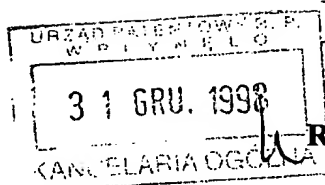
**2. Citations and explanations**

**see separate sheet**

**Ad section V**

1. The present application relates to a power-operated tool for driving fasteners into a base, said tool being of the type operated by combustion pressure generated by detonation of a cartridge and including:
  - a tool body, a cylindrical barrel member, and a combustion chamber within the barrel member for receiving the cartridge in preparation for firing, which upon ignition, propels a piston forwardly for the driving of a fastener,
  - a piston mounted for reciprocation within the barrel member and having a contact surface facing a predetermined direction, and
  - a piston return and buffering system which is positioned to be contacted by the piston's contact surface as the piston is moved in the predetermined direction, said system being provided to return the piston to its firing position and also to absorb the energy of the piston in the event of a free-flight shot or accidental overdriving of the piston.
2. The subject-matter of independent apparatus claims 1 is new in terms of the relevant state of the art (Article 33(2) PCT), since none of the documents cited in the International Search Report or acknowledged in the description discloses the combination of all the features set out in claim 1.
3. The document US-A-3 331 546 (**D1**) which is cited in the description on page 2 is considered to represent the closest prior art in respect of the subject-matter of claim 1.
- 3.1 (**D1**) discloses the following combination of features expressed in terms of claim 1:
  - "A power-actuated piston tool with piston automatic return, comprising:
    - an external barrel with a guiding barrel situated therewithin,
    - a piston means mounted for reciprocation within the guiding barrel between firing position and fastening position,
    - a firing-pin assembly situated at the rear end of the external barrel and operatively connected therewith, and
    - means for automatic return of piston means from its fastening position to its firing position, situated on the piston shank between the piston head and the fastener guide."

- 3.2 The subject-matter of claim 1 is distinguished from the embodiment of the fastener driving tool known from (D1) in that "said means for automatic piston return is a **one-piece elastic returning bush** made of elastomeric material in the shape of bellow, whose diameters both external and internal are regularly varied, creating uniformly spaced swellings and narrowings of wave like structure".
4. Compared with the document (D1), the technical problem to be solved by the present application is, therefore, the provision of an alternative piston return and buffering system in a propellant tool, which system ensures a better damping of the piston's movement in the axial direction by means of a bellow-like elastic stop member made of elastomeric material and prevents serious damage to the tool.
5. The solution to this problem, which is to be found in the combination of features set out in claim 1, is not mentioned in any of the cited documents and is hence indisputably new.
- 5.1 Moreover, there is absolutely no suggestion in (D1) that an assembly for decelerating the piston during its power stroke in a propellant tool of the type known from (D1) could be adapted as defined by the features mentioned in section 3.2, so as to be suitable for the purpose above.
- 5.2 Nor do the other available prior art documents furnish any hint which might suggest the solution according to claim 1. The available prior art documents relate **either** to fastener driving tools of a different type, **or** to piston stop assemblies of a different design used in propellant tools for driving fasteners, **or** to vibration-dampers used in vehicle suspension arrangements.
- For the above reasons, the subject-matter of claim 1 is considered to involve an inventive step, and therefore does satisfy the criterion set forth in Article 33(3) PCT.
6. Claims 2-7 are dependent on claim 1 and are concerned with particular embodiments of the power-actuated piston tool for driving fasteners according to the independent claim, and thus also meet the requirements of Articles 33(2) and 33(3) PCT.
7. It is also self evident that the subject-matter of claims 1-7 can be considered as being susceptible of industrial application within the meaning of Article 33(4) PCT.

**PCT****REQUEST**

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. **PCT/PL 98/00052**International Filing Date **31.12.1998**

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum)**Box No. I TITLE OF INVENTION****POWER OPERATED PISTON TOOL WITH PISTON AUTOMATIC RETURN****Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ŁAGODZIŃSKI Marek  
ul. ĆWIKLIŃSKIEJ 2 m 19  
92-508 ŁÓDŹ  
POLAND

☒ This person is also inventor.Telephone No.  
(0048 42) 2140101Facsimile No.  
(0048 42) 2140333

Teleprinter No.

State (that is, country) of nationality: **PL**State (that is, country) of residence: **PL**

This person is applicant for the purposes of: ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ŁAGODZIŃSKA Bogusława  
ul. ĆWIKLIŃSKIEJ 2 m 19  
92-508 ŁÓDŹ  
POLAND

This person is:

☐ applicant only☒ applicant and inventor☐ inventor only (If this check-box is marked, do not fill in below.)State (that is, country) of nationality: **PL**State (that is, country) of residence: **PL**

This person is applicant for the purposes of: ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent ☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

WRÓBLEWSKI Michał  
ul. BATALIONÓW CHŁOPSKICH 14 m 100  
94-058 ŁÓDŹ  
POLAND

Telephone No.  
(0048 42) 6873230Facsimile No.  
(0048 42) 6873230

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

## Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ROGOWSKI Zbigniew  
ul. DĄBRÓWKI 17 m 25  
92-413 ŁÓDŹ  
POLAND

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

PL

State (that is, country) of residence:

PL

This person is applicant for the purposes of:

- ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

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Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

**Box No.V DESIGNATION OF STATES**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☐ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

**National Patent (if other kind of protection or treatment desired, specify on dotted line):**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> <b>AL</b> Albania .....                               | <input checked="" type="checkbox"/> <b>LS</b> Lesotho .....                                   |
| <input checked="" type="checkbox"/> <b>AM</b> Armenia .....                               | <input checked="" type="checkbox"/> <b>LT</b> Lithuania .....                                 |
| <input type="checkbox"/> <b>AT</b> Austria .....  | <input type="checkbox"/> <b>LU</b> Luxembourg .....   |
| <input checked="" type="checkbox"/> <b>AU</b> Australia .....                             | <input checked="" type="checkbox"/> <b>LV</b> Latvia .....                                    |
| <input checked="" type="checkbox"/> <b>AZ</b> Azerbaijan .....                            | <input checked="" type="checkbox"/> <b>MD</b> Republic of Moldova .....                       |
| <input checked="" type="checkbox"/> <b>BA</b> Bosnia and Herzegovina .....                | <input checked="" type="checkbox"/> <b>MG</b> Madagascar .....                                |
| <input checked="" type="checkbox"/> <b>BB</b> Barbados .....                              | <input checked="" type="checkbox"/> <b>MK</b> The former Yugoslav Republic of Macedonia ..... |
| <input checked="" type="checkbox"/> <b>BG</b> Bulgaria .....                              | <input checked="" type="checkbox"/> <b>MN</b> Mongolia .....                                  |
| <input checked="" type="checkbox"/> <b>BR</b> Brazil .....                                | <input checked="" type="checkbox"/> <b>MW</b> Malawi .....                                    |
| <input checked="" type="checkbox"/> <b>BY</b> Belarus .....                               | <input checked="" type="checkbox"/> <b>MX</b> Mexico .....                                    |
| <input checked="" type="checkbox"/> <b>CA</b> Canada .....                                | <input checked="" type="checkbox"/> <b>NO</b> Norway .....                                    |
| <input type="checkbox"/> <b>CH and LI</b> Switzerland and Liechtenstein .....             | <input checked="" type="checkbox"/> <b>NZ</b> New Zealand .....                               |
| <input checked="" type="checkbox"/> <b>CN</b> China .....                                 | <input type="checkbox"/> <b>PL</b> Poland .....   |
| <input checked="" type="checkbox"/> <b>CU</b> Cuba .....                                  | <input type="checkbox"/> <b>PT</b> Portugal .....   |
| <input checked="" type="checkbox"/> <b>CZ</b> Czech Republic .....                        | <input checked="" type="checkbox"/> <b>RO</b> Romania .....                                   |
| <input type="checkbox"/> <b>DE</b> Germany .....  | <input checked="" type="checkbox"/> <b>RU</b> Russian Federation .....                        |
| <input type="checkbox"/> <b>DK</b> Denmark .....  | <input checked="" type="checkbox"/> <b>SD</b> Sudan .....                                     |
| <input checked="" type="checkbox"/> <b>EE</b> Estonia .....                               | <input type="checkbox"/> <b>SE</b> Sweden .....   |
| <input type="checkbox"/> <b>ES</b> Spain .....  | <input checked="" type="checkbox"/> <b>SG</b> Singapore .....                                 |
| <input type="checkbox"/> <b>FI</b> Finland .....  | <input checked="" type="checkbox"/> <b>SI</b> Slovenia .....                                  |
| <input type="checkbox"/> <b>GB</b> United Kingdom .....                                   | <input checked="" type="checkbox"/> <b>SK</b> Slovakia .....                                  |
| <input checked="" type="checkbox"/> <b>GE</b> Georgia .....                               | <input checked="" type="checkbox"/> <b>SL</b> Sierra Leone .....                              |
| <input checked="" type="checkbox"/> <b>GH</b> Ghana .....                                 | <input checked="" type="checkbox"/> <b>TJ</b> Tajikistan .....                                |
| <input checked="" type="checkbox"/> <b>GM</b> Gambia .....                                | <input checked="" type="checkbox"/> <b>TM</b> Turkmenistan .....                              |
| <input type="checkbox"/> <b>GW</b> Guinea-Bissau .....                                    | <input checked="" type="checkbox"/> <b>TR</b> Turkey .....                                    |
| <input checked="" type="checkbox"/> <b>HR</b> Croatia .....                               | <input checked="" type="checkbox"/> <b>TT</b> Trinidad and Tobago .....                       |
| <input checked="" type="checkbox"/> <b>HU</b> Hungary .....                               | <input checked="" type="checkbox"/> <b>UA</b> Ukraine .....                                   |
| <input checked="" type="checkbox"/> <b>ID</b> Indonesia .....                             | <input checked="" type="checkbox"/> <b>UG</b> Uganda .....                                    |
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| <input checked="" type="checkbox"/> <b>IS</b> Iceland .....                               | <input checked="" type="checkbox"/> <b>UZ</b> Uzbekistan .....                                |
| <input checked="" type="checkbox"/> <b>JP</b> Japan .....                                 | <input checked="" type="checkbox"/> <b>VN</b> Viet Nam .....                                  |
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The undersigned applicant(s) (Names should be indicated as they appear in the request):

1. ŁAGODZIŃSKI Marek
2. ŁAGODZIŃSKA Bogusława
3. ROGOWSKI Zbigniew

hereby appoints (appoint) the following person as:



agent



common representative

**Name and address**

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

WRÓBLEWSKI Michał  
ul. BATALIONÓW CHŁOPSKICH 14 m 100  
94-058 ŁÓDŹ  
POLAND

to represent the undersigned before



all the competent International Authorities



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in connection with the international application identified below:

Title of the Invention:

POWER OPERATED PISTON TOOL  
WITH PISTON AUTOMATIC RETURN

Applicant's or agent's file reference:

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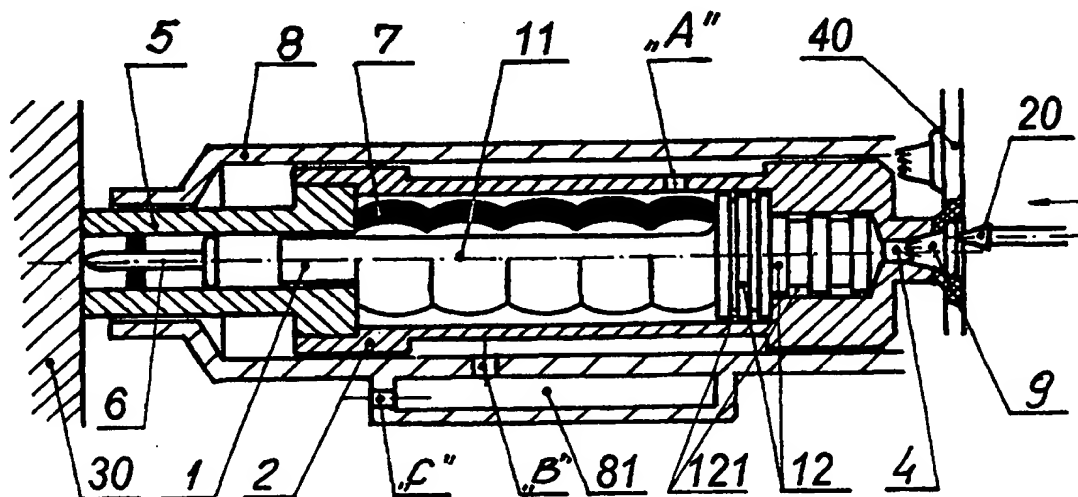
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/PL98/00052</p> <p>(22) International Filing Date: 31 December 1998 (31.12.98)</p> <p>(30) Priority Data: P.324361 19 January 1998 (19.01.98) PL</p> <p>(71)(72) Applicants and Inventors: ŁAGODZIŃSKI, Marek [PL/PL]; ul. Ćwiklińskiej 2 m 19, PL-92-508 Łódź (PL). ŁAGODZIŃSKA, Bogusława [PL/PL]; ul. Ćwiklińskiej 2 m 19, PL-92-508 Łódź (PL). ROGOWSKI, Zbigniew [PL/PL]; ul. Dąbrówki 17 m 25, PL-92-413 Łódź (PL).</p> <p>(74) Agent: WRÓBLEWSKI, Michał; ul. Batalionów Chłopskich 14 m 100, PL-94-058 Łódź (PL).</p>		<p>(81) Designated States: AL, AM, AU, AZ, BA, BB, BG, BR, BY, CA, CN, CU, CZ, EE, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LV, MD, MG, MK, MN, MW, MX, NO, NZ, RO, RU, SD, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p><b>Published</b> With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: POWER OPERATED PISTON TOOL WITH PISTON AUTOMATIC RETURN



## (57) Abstract

The present invention provides a defect-less and easy to operate power actuated piston tool with automatic piston return, designated for driving fasteners into a base like masonry, concrete, wood or the like. The tool according to the invention is characterized by that on piston shank (11) of piston (1), there is an elastic returning bush (7), situated between piston head (12) and fastener guide (5), said returning bush (7) is a one-piece in shape of bellow, made of elastomeric material, of regularly variable diameter.

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Power operated piston tool with  
piston automatic return

5       The object of this invention is a power operated piston tool with piston automatic return.

      In power operated piston tools, of indirect action, designed for driving fastening elements into a base like masonry, concrete, wood or the like, a piston element, driven by firing  
10   gases, coming from firing cartridge, is used as an intermediary element, acting upon the fastener, as opposite to tools of direct action, where firing gases act directly upon fastening element.

      In tools of indirect action, the piston after fastening is in its forward position, that is piston shank tip is at the fastener  
15   guide muzzle end. In order to return the piston to its firing position, in conventional, semiautomatic tools, manual reloading is required. This reloading consists of pulling backward the barrel means, having a returning tooth, engaging the respective cavity on piston means, which causes the piston to return. This  
20   operation is also used to shift the firing cartridge belt about one position, thus making the tool ready for next firing.

      In other kind of power piston tools, described in patent EP 0223740, the piston return is actuated by the firing gases which, after pushing the piston to its forward position, while still  
25   expanding, cause the piston to retract. However, after retracting, the piston strikes against its rear abutment, thus causing the reflection effect, which may displace the piston of some distance from its firing position, creating a dead space, decreasing the firing power of a subsequent fire. As a result,  
30   fasteners are driven into the base at uneven depth and the firing chamber becomes spoiled with firing remains, due to incomplete

burning of blowing charge. Besides, problems can occur when the piston itself is driven into the base after fastening operation. In that case, to return the piston to its firing position, an additional manual push-rod is needed. In any case, after transporting or other periods of prolonged disuse of the tool, it is always useful to check with manual push-rod, whether the piston is well in its firing position, the only one initial position ensuring tool correct functioning.

In another kind of power piston tool, illustrated in US patent No 3,331,546, to return the piston member, a plurality of stacked washers constructed from polyurethane elastomer, are applied. The washers are positioned within the barrel, on the piston shank. After firing the washers are rapidly collapsed, thus absorbing part of firing energy and functioning as a buffer. At the end of power stroke, and after dissipation of the firing gases, escaping through vent holes in the barrel, the washers will return to their original shape, due to elastic memory, and thus they return piston to its firing position. The venting holes, situated in washers' side portions cause stress concentration and thus damage to spring elements. The other problem arises when exchanging worn-out washer elements, as they require strictly defined positions and quantity, otherwise malfunction may occur, if not a serious tool damage.

It is an object of this invention to provide a power operated piston tool, free from above mentioned imperfections, in which the piston return is carried-out mechanically, by use of one-piece elastic returning bush. The returning bush is situated on piston shank between piston head and fastener guide, is made of elastomeric material and has a shape of bellow, whose diameters both external and internal are regularly varied. The walls of so formed returning bush are approximate in shape to a

sinusoid, or to a stack of frusto-spherical segments, or frusto-conical segments, or stack of barrel-shape segments or/and  
65 other surface of revolution segments, creating uniformly spaced swellings and narrowings of wave like structure.

The returning bush according to this invention advantageously has the maximal internal diameter of at least one segment at its both ends of slightly smaller size than the  
70 respective diameter of remaining segments, so the end segment walls are thicker than others segment walls.

The internal end surface of external segments is markedly curved outside in such a way, that the position of curvature points of bush ends is clearly distanced from bush face. The  
75 length of returning bush is selected in such a way that after initial blocking, the piston shank end face does not reach its extreme forward position and remains at a distance from the base, the distance slightly greater than the head height of fastening element. The maximal external diameter of returning  
80 bush according to present invention is smaller enough than the internal diameter of guiding barrel, that after initial blocking of the bush, its external diameter still remains smaller than internal diameter of guiding bush, thus preserving the slight clearance.

85 After driving fully the fastening element into the base, and subsequent stopping the piston movement, the energy accumulated in the returning bush is being relieved and rejects the piston to the rear, due to shape memory of elastomeric material. It is the first and the greatest returning force acting  
90 upon the piston. After returning the piston to its rear position, there remains some slight force due to not fully recovering the bush free shape, which force retains the piston in its rear position that is firing position.

The object of this invention is illustrated in a preferable  
95 embodiment in the accompanying drawings in which fig.1 is a  
longitudinal cross sectional view of the power piston tool,  
showing the piston in its firing position, at the moment of firing  
the cartridge, fig.2 is the same view showing the piston at the  
end of normal power stroke, at the moment of driving the  
100 fastening element into a base, after initial blocking of returning  
bush, fig.3 is the same view after driving the fastening element  
fully into the base, fig.4 is the cross sectional view of middle  
part of the returning bush and fig.5 is somewhat enlarged view  
of one of returning bush end in cross section.

105 In power tool shown in fig.1 a piston 1, mounted for  
reciprocation within the guiding barrel 2, is in its firing position  
at the rear end of the barrel 2 where the piston head 12 is, as  
near, as possible, to the firing chamber 4. On piston shank 11,  
between the piston head 12 and fastener guide 5 an elastic  
110 returning bush 7 is situated, being in the shape of one piece  
bellow, constructed from an elastomer, whose diameters both  
external and internal are regularly varied. The walls of so  
formed returning bush 7 are approximate in shape to a stack of  
frusto-spherical segments, creating uniformly spaced swellings  
115 and narrowings of wave like structure. In another embodiment of  
the invention the returning bush is of shape of stack of frusto-  
conical segments. In yet another embodiment of the invention,  
the returning bush is of shape of the stack of barrel shape  
segments or/and another surface of revolution segments. The  
120 returning bush 7 has the maximal internal diameter D4, of its  
extreme two segments at its both ends, of slightly smaller size  
than the respective diameter D2 of remaining segments, so that  
the bush end segment walls are a little thicker than other  
segments walls. The internal end surface of external segments

125 is markedly curved outside in such a way, that the position 71 of  
curvature points of bush ends is clearly distanced from the bush  
faces 72. The length of the returning bush 7 is selected in such  
a way that after initial blocking of the returning bush 7, the  
piston shank 1 end face does not reach its extreme forward  
130 position and remains at a distance from the base 30 the  
distance slightly greater than the head height of fastening  
element 6. The maximal external diameter D1 of the returning  
bush 7 is smaller enough than the internal diameter of the  
guiding barrel 2, that, after initial blocking of the returning bush  
135 7, its external diameter still remains smaller than internal  
diameter of the guiding bush 2, thus preserving a slight  
clearance. When the piston 1 is in its firing position, an initial  
stress within the returning bush 7 remains, enough to ensure  
that the piston head 12 abuts the bottom of the barrel 2, near  
140 the firing chamber 4. On the piston head 12 there is a plurality  
of grooves 121, acting as sealing means for firing gases and  
providing some space to gather impurities. Ports A in the  
guiding barrel 2 and ports B and C in external barrel 8 are  
provided to enable the firing gases evacuation after firing.

145 After firing the cartridge 9 upon striking the firing pin 20,  
the firing gases set the piston 1 into motion, with rapidly  
accelerating velocity, towards the fastener 6. Piston head 12,  
after passing the port A, opens gas flow connection toward the  
space between the guiding barrel 2 and external barrel 8 and  
150 from there, through port B, toward silencer 11 and from there,  
via port C, into the atmosphere, thus reducing the firing noise  
and gas pressure in firing chamber, to value close to  
atmospheric pressure. Accelerated piston 1 strikes against  
fastener 6, driving it into base 30, and at the same time,  
155 compressing the returning bush 7. At a distance of several

millimeters before fully setting the fastener 6 into the base 30 initial blocking of the returning bush 7 takes place. In this position the piston shank 1 end face does not reach its extreme forward position and remains at some distance from the base 30 slightly greater than the head height of the fastener 6 and a clearance exists between the guiding barrel 2 and returning bush 7. The returning bush 7, at the final stage of the piston 1 motion, forms a shut tubular column, thus absorbing little firing energy which ensures driving the fastening element 6 to the full depth. In the event of free flight shot or overdrive of the piston, this shut tubular column will function as a buffer, to absorb the high energy of the piston 1.

After thrusting the fastener 6 into the base 30, the piston 1 stops and due to elastic memory, inherent in elastomeric material, the returning bush 7 will return the piston 1 to its firing position, where it is ready for the next firing operation, the more easier that the counter-pressure acting upon the piston 1 from the firing chamber 4, has fallen to atmospheric pressure.

To reload the power piston tool, it should be removed from the contact with the base 30, then the springs of firing-pin assembly move the subassembly of piston 1 and its guiding barrel 2 forward, about a stroke, enabling : first to remove the used firing cartridge 9 from the firing chamber 4 and, secondly, after the tool is pressed anew against base 30 for the subsequent firing, to shift the cartridge belt 40 about one position.

By virtue of particular configuration of the elastic returning bush 7, during the normal power stroke, substantially little energy will be absorbed by the returning bush 7 being pressed, and thus there will be little interference with the velocity of the piston 1, so the bulk of firing energy is used for driving the



fastener 7 into base 30, while only small portion of this energy will be used for returning the piston 1 to its firing position, thus reducing the tool reflection effect and ensuring that the piston 1 will always return to its firing position, after venting the space behind its head 12. The particular wave like shape of returning bush 7, as well as, thickening the bush 7 end segments and particular position of curvature points of bush 7 ends ensures correct functioning of the tool and eliminates the elastomeric bush tendency to curl, which tendency could drive to a situation when the piston 1 could be blocked within the guiding barrel 2. Besides, the returning bush 7 does not oppose a great resistance to the piston 1 movement, so it does not brake its velocity and it does not impair the effectiveness of fastening the fasteners and does not provoke any tool reflection effect.

## Claims

1.A power actuated piston tool with piston automatic return, comprising an external barrel with a guiding barrel  
5 situated there within, a piston means mounted for reciprocation within said guiding barrel, between firing position and fastening position, a firing-pin assembly, situated at the rear end of external barrel, operatively connected therewith, and means for automatic return of piston means from its fastening position to  
10 its firing position, situated on piston shank between piston head and fastener guide, said means for automatic piston return is a one-piece elastic returning bush (7) made of elastomeric material in the shape of bellow, whose diameters both external and internal are regularly varied, creating uniformly spaced  
15 swellings and narrowings of wave like structure.

2.A power actuated piston tool, according to claim 1, wherein the walls of returning bush (7) are approximate in shape to a sinusoid, or to a stack of frusto-spherical segments, or to a stack of frusto-conical segments, or to a stack of barrel  
20 shape segments and/or other surface of revolution segments.

3.A power actuated piston tool, according to claim 1 or 2, wherein the maximal internal diameter (D4) of at least one segment of the returning bush (7) at its both ends, is of smaller size than respective diameter (D2) of the remaining segments.

25 4.A power actuated piston tool, according to claim 1 or 2, wherein the end segment walls of returning bush (7) are thicker than other segment walls.

5. A power actuated piston tool, according to claim 1 or 2, wherein the internal end surface of external segments of  
30 returning bush (7) is markedly curved outside in such a way, that the position of curvature points (71) is clearly distanced from the returning bush (7) face (72).

6. A power actuated piston tool, according to claim 1 or 2, wherein the length of the returning bush (7) is selected in such a way, that after initial blocking, the piston shank (1) end face does not reach its extreme forward position and remains at a distance from the base (30), the distance greater than the head height of fastening element (6).

7. A power actuated piston tool, according to claim 1 or 2, wherein the maximal external diameter (D1) of the returning bush (7) is smaller enough than the internal diameter of the guiding barrel (2), that after initial blocking of the returning bush (7), its external diameter still remains smaller than the internal diameter of the guiding bush (2), thus preserving the small clearance.

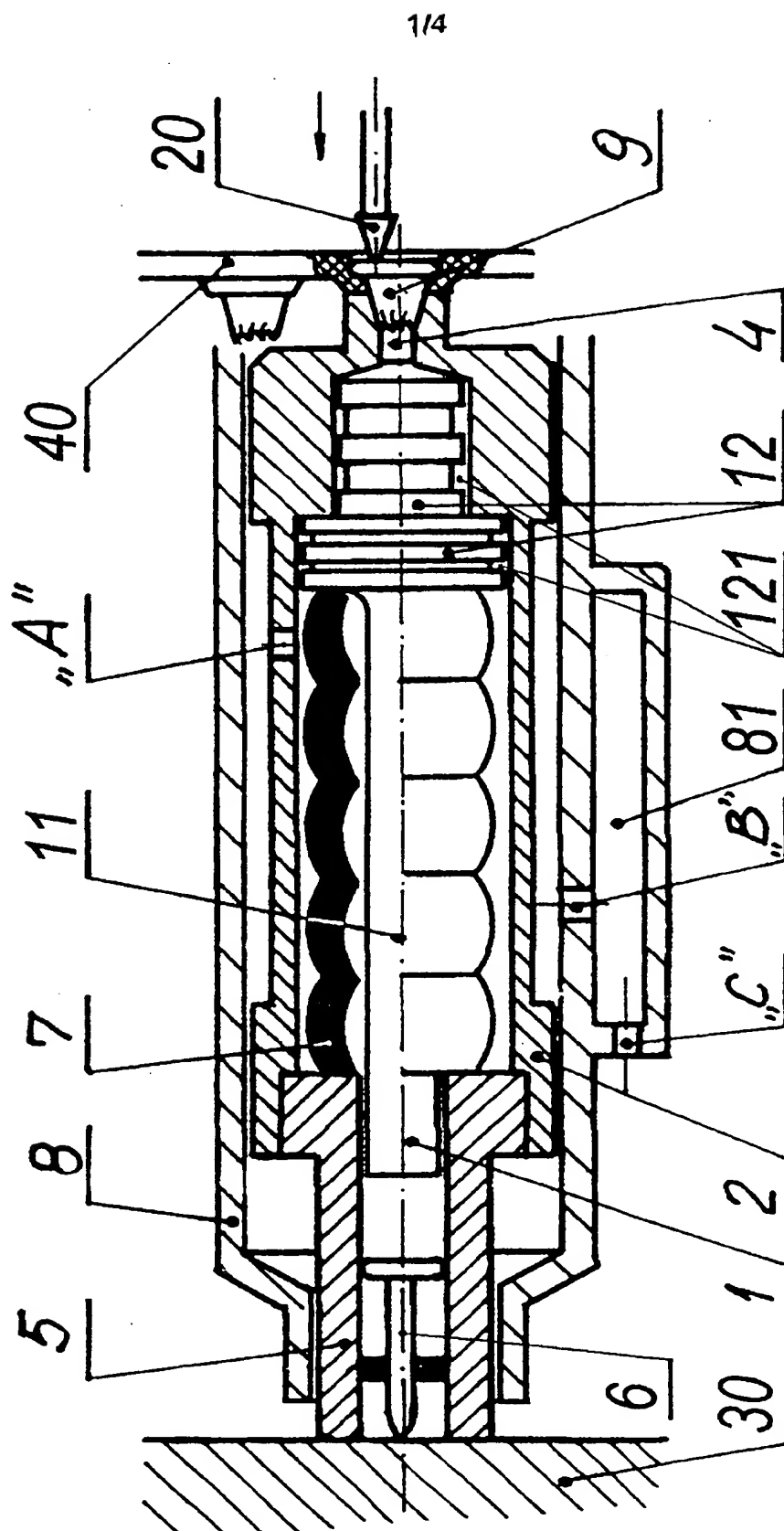


Fig. 1

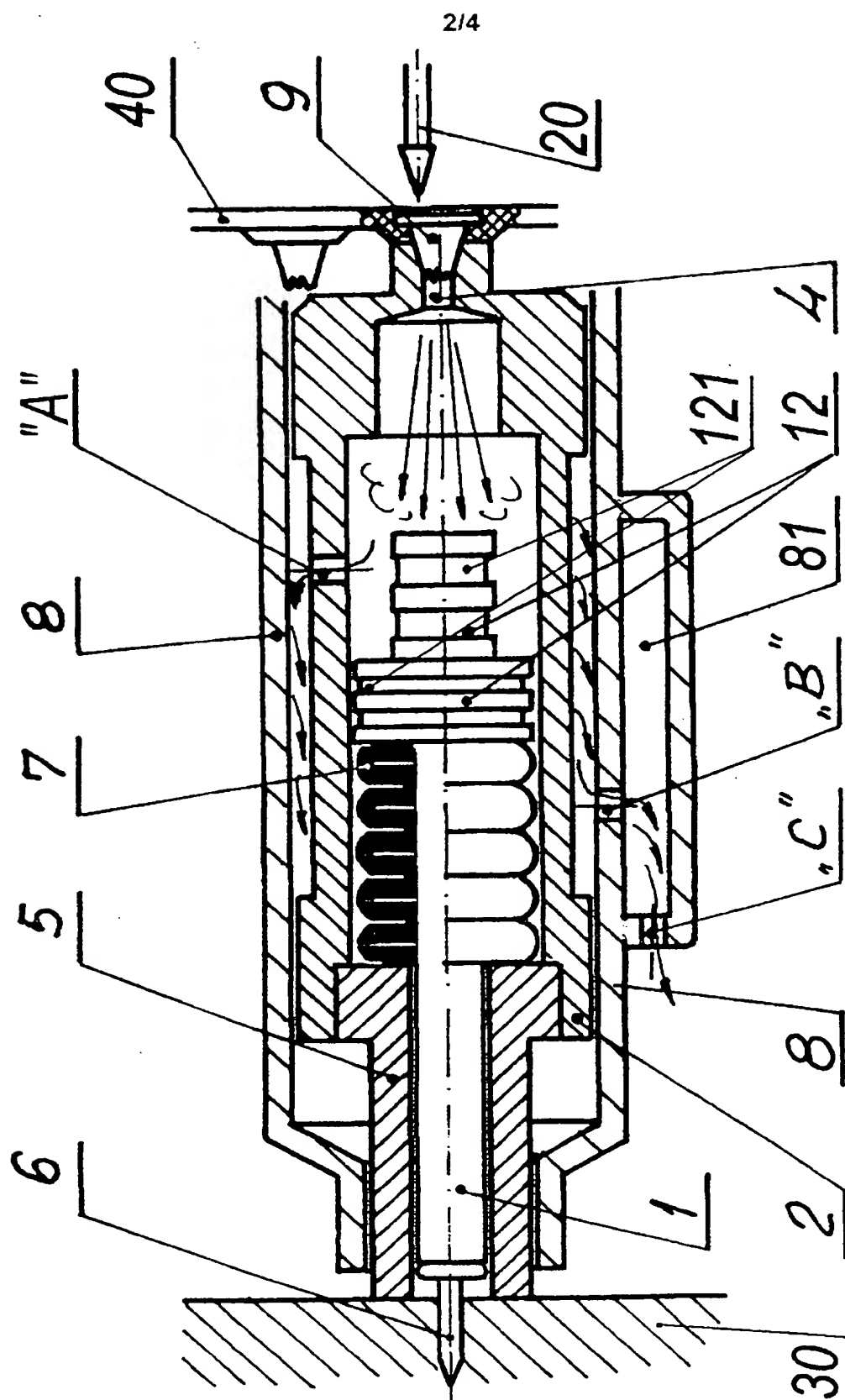


Fig. 2

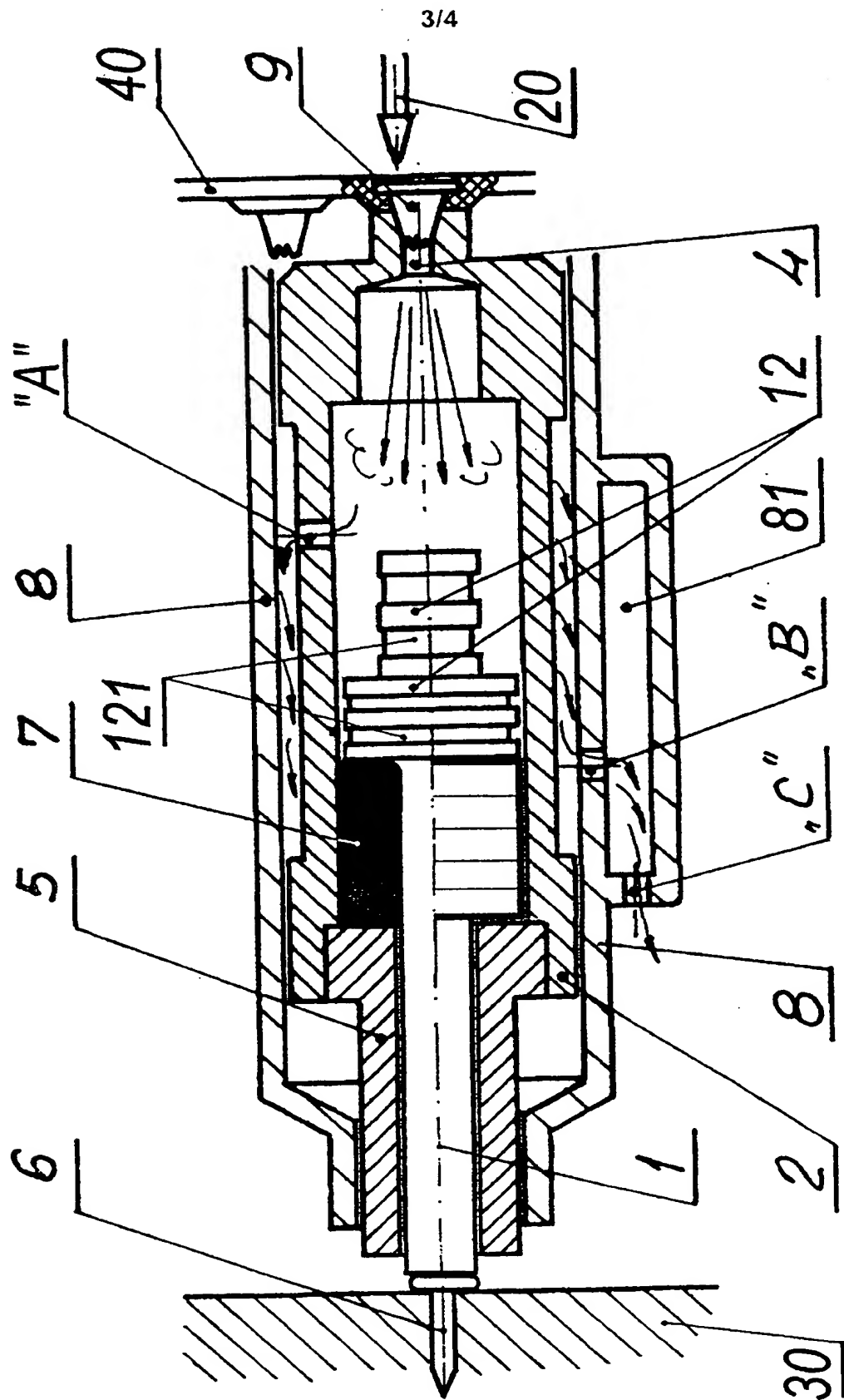


Fig. 3

4/4

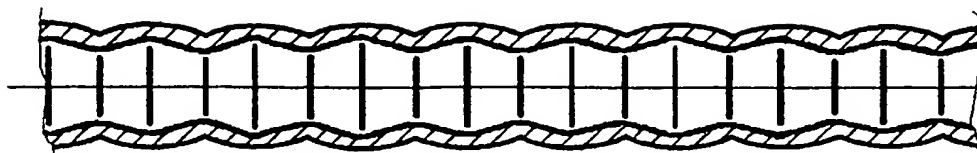


Fig. 4

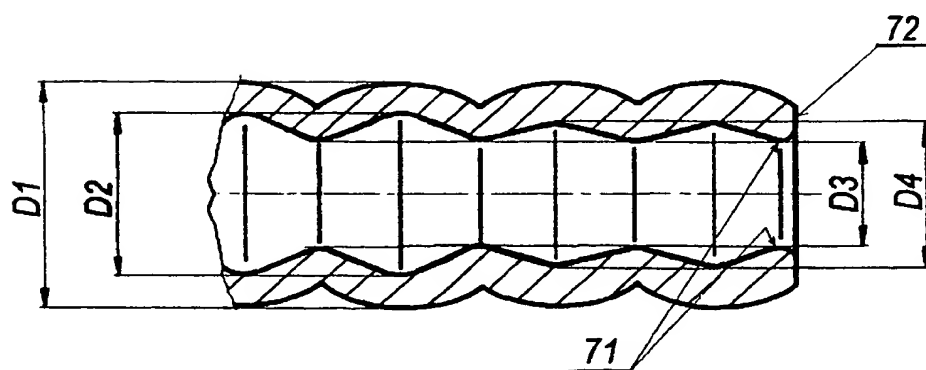


Fig. 5

# INTERNATIONAL SEARCH REPORT

International Application No.

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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 B25C1/14

According to International Patent Classification (IPC) or to both national classification and IPC

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IPC 6 B25C F16F

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 331 546 A (BRUNELLE) 18 July 1967 cited in the application see column 2, line 29-35; figures 1-3	1,2,4
A	EP 0 732 178 A (ADOLF WÜRTH) 18 September 1996 see column 7, line 28-41 see column 10, line 33-45; figures 3,10	1,7
Y	DE 31 51 771 A (METZELER KAUTSCHUK) 14 July 1983 see claims 1,7; figures 1-3	1,2,4
A	DE 18 11 684 U (PORSCHE) see claim 1; figure 1	2,3,5,7
A	DE 11 03 775 B (PAUL HENSS) see column 1, line 1-8; figures 1,2	3,5
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Date of the actual completion of the international search

9 June 1999

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21/06/1999

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 559 862 A (COMPAGNIE DES PRODUITS INDUSTRIELS DE L'OUEST) 23 August 1985 see abstract; figures 2,3 -----	2,3

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/PL 98/00052

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3331546 A	18-07-1967	BE 681919 A	01-12-1966
		DE 1603918 A	28-01-1971
		FR 1481590 A	18-08-1967
		GB 1142869 A	
		NL 6607554 A	02-12-1966
		US 3368730 A	13-02-1968
EP 732178 A	18-09-1996	DE 19509763 A	19-09-1996
DE 3151771 A	14-07-1983	NONE	
DE 1811684 U		NONE	
DE 1103775 B		NONE	
FR 2559862 A	23-08-1985	NONE	

Power operated piston tool with  
piston automatic return

5       The object of this invention is a power operated piston tool  
with piston automatic return.

      In power operated piston tools, of indirect action, designed  
for driving fastening elements into a base like masonry,  
concrete, wood or the like, a piston element, driven by firing  
10   gases, coming from firing cartridge, is used as an intermediary  
element, acting upon the fastener, as opposite to tools of direct  
action, where firing gases act directly upon fastening element.

      In tools of indirect action, the piston after fastening is in  
its forward position, that is piston shank tip is at the fastener  
15   guide muzzle end. In order to return the piston to its firing  
position, in conventional, semiautomatic tools, manual reloading  
is required. This reloading consists of pulling backward the  
barrel means, having a returning tooth, engaging the respective  
cavity on piston means, which causes the piston to return. This  
20   operation is also used to shift the firing cartridge belt about one  
position, thus making the tool ready for next firing.

      In other kind of power piston tools, described in patent EP  
0223740, the piston return is actuated by the firing gases which,  
after pushing the piston to its forward position, while still  
25   expanding, cause the piston to retract. However, after  
retracting, the piston strikes against its rear abutment, thus  
causing the reflection effect, which may displace the piston of  
some distance from its firing position, creating a dead space,  
decreasing the firing power of a subsequent fire. As a result,  
30   fasteners are driven into the base at uneven depth and the firing  
chamber becomes spoiled with firing remains, due to incomplete

burning of blowing charge. Besides, problems can occur when the piston itself is driven into the base after fastening operation. In that case, to return the piston to its firing position, 35 an additional manual push-rod is needed. In any case, after transporting or other periods of prolonged disuse of the tool, it is always useful to check with manual push-rod, whether the piston is well in its firing position, the only one initial position ensuring tool correct functioning.

40 In another kind of power piston tool, illustrated in US patent No 3,331,546, to return the piston member, a plurality of stacked washers constructed from polyurethane elastomer, are applied. The washers are positioned within the barrel, on the piston shank. After firing the washers are rapidly collapsed, 45 thus absorbing part of firing energy and functioning as a buffer. At the end of power stroke, and after dissipation of the firing gases, escaping through vent holes in the barrel, the washers will return to their original shape, due to elastic memory, and thus they return piston to its firing position. The venting holes, 50 situated in washers' side portions cause stress concentration and thus damage to spring elements. The other problem arises when exchanging worn-out washer elements, as they require strictly defined positions and quantity, otherwise malfunction may occur, if not a serious tool damage.

55 It is an object of this invention to provide a power operated piston tool, free from above mentioned imperfections, in which the piston return is carried-out mechanically, by use of one-piece elastic returning bush. The returning bush is situated on piston shank between piston head and fastener guide, is 60 made of elastomeric material and has a shape of bellow, whose diameters both external and internal are regularly varied. The walls of so formed returning bush are approximate in shape to a

sinusoid, or to a stack of frusto-spherical segments, or frusto-conical segments, or stack of barrel-shape segments or/and  
65 other surface of revolution segments, creating uniformly spaced swellings and narrowings of wave like structure.

The returning bush according to this invention advantageously has the maximal internal diameter of at least one segment at its both ends of slightly smaller size than the  
70 respective diameter of remaining segments, so the end segment walls are thicker than others segment walls.

The internal end surface of external segments is markedly curved outside in such a way, that the position of curvature points of bush ends is clearly distanced from bush face. The  
75 length of returning bush is selected in such a way that after initial blocking, the piston shank end face does not reach its extreme forward position and remains at a distance from the base, the distance slightly greater than the head height of fastening element. The maximal external diameter of returning  
80 bush according to present invention is smaller enough than the internal diameter of guiding barrel, that after initial blocking of the bush, its external diameter still remains smaller than internal diameter of guiding bush, thus preserving the slight clearance.

85 After driving fully the fastening element into the base, and subsequent stopping the piston movement, the energy accumulated in the returning bush is being relieved and rejects the piston to the rear, due to shape memory of elastomeric material. It is the first and the greatest returning force acting  
90 upon the piston. After returning the piston to its rear position, there remains some slight force due to not fully recovering the bush free shape, which force retains the piston in its rear position that is firing position.

The object of this invention is illustrated in a preferable  
95 embodiment in the accompanying drawings in which fig.1 is a  
longitudinal cross sectional view of the power piston tool,  
showing the piston in its firing position, at the moment of firing  
the cartridge, fig.2 is the same view showing the piston at the  
end of normal power stroke, at the moment of driving the  
100 fastening element into a base, after initial blocking of returning  
bush, fig.3 is the same view after driving the fastening element  
fully into the base, fig.4 is the cross sectional view of middle  
part of the returning bush and fig.5 is somewhat enlarged view  
of one of returning bush end in cross section.

105 In power tool shown in fig.1 a piston 1, mounted for  
reciprocation within the guiding barrel 2, is in its firing position  
at the rear end of the barrel 2 where the piston head 12 is, as  
near, as possible, to the firing chamber 4. On piston shank 11,  
between the piston head 12 and fastener guide 5 an elastic  
110 returning bush 7 is situated, being in the shape of one piece  
bellow, constructed from an elastomer, whose diameters both  
external and internal are regularly varied. The walls of so  
formed returning bush 7 are approximate in shape to a stack of  
frusto-spherical segments, creating uniformly spaced swellings  
115 and narrowings of wave like structure. In another embodiment of  
the invention the returning bush is of shape of stack of frusto-  
conical segments. In yet another embodiment of the invention,  
the returning bush is of shape of the stack of barrel shape  
segments or/and another surface of revolution segments. The  
120 returning bush 7 has the maximal internal diameter D4, of its  
extreme two segments at its both ends, of slightly smaller size  
than the respective diameter D2 of remaining segments, so that  
the bush end segment walls are a little thicker than other  
segments walls. The internal end surface of external segments

125 is markedly curved outside in such a way, that the position 71 of  
curvature points of bush ends is clearly distanced from the bush  
faces 72. The length of the returning bush 7 is selected in such  
a way that after initial blocking of the returning bush 7, the  
piston shank 1 end face does not reach its extreme forward  
130 position and remains at a distance from the base 30 the  
distance slightly greater than the head height of fastening  
element 6. The maximal external diameter D1 of the returning  
bush 7 is smaller enough than the internal diameter of the  
guiding barrel 2, that, after initial blocking of the returning bush  
135 7, its external diameter still remains smaller than internal  
diameter of the guiding bush 2, thus preserving a slight  
clearance. When the piston 1 is in its firing position, an initial  
stress within the returning bush 7 remains, enough to ensure  
that the piston head 12 abuts the bottom of the barrel 2, near  
140 the firing chamber 4. On the piston head 12 there is a plurality  
of grooves 121, acting as sealing means for firing gases and  
providing some space to gather impurities. Ports A in the  
guiding barrel 2 and ports B and C in external barrel 8 are  
provided to enable the firing gases evacuation after firing.

145 After firing the cartridge 9 upon striking the firing pin 20,  
the firing gases set the piston 1 into motion, with rapidly  
accelerating velocity, towards the fastener 6. Piston head 12,  
after passing the port A, opens gas flow connection toward the  
space between the guiding barrel 2 and external barrel 8 and  
150 from there, through port B, toward silencer 11 and from there,  
via port C, into the atmosphere, thus reducing the firing noise  
and gas pressure in firing chamber, to value close to  
atmospheric pressure. Accelerated piston 1 strikes against  
fastener 6, driving it into base 30, and at the same time,  
155 compressing the returning bush 7. At a distance of several

millimeters before fully setting the fastener 6 into the base 30 initial blocking of the returning bush 7 takes place. In this position the piston shank 1 end face does not reach its extreme forward position and remains at some distance from the base 30 slightly greater than the head height of the fastener 6 and a clearance exists between the guiding barrel 2 and returning bush 7. The returning bush 7, at the final stage of the piston 1 motion, forms a shut tubular column, thus absorbing little firing energy which ensures driving the fastening element 6 to the full depth. In the event of free flight shot or overdrive of the piston, this shut tubular column will function as a buffer, to absorb the high energy of the piston 1.

After thrusting the fastener 6 into the base 30, the piston 1 stops and due to elastic memory, inherent in elastomeric material, the returning bush 7 will return the piston 1 to its firing position, where it is ready for the next firing operation, the more easier that the counter-pressure acting upon the piston 1 from the firing chamber 4, has fallen to atmospheric pressure.

To reload the power piston tool, it should be removed from the contact with the base 30, then the springs of firing-pin assembly move the subassembly of piston 1 and its guiding barrel 2 forward, about a stroke, enabling : first to remove the used firing cartridge 9 from the firing chamber 4 and, secondly, after the tool is pressed anew against base 30 for the subsequent firing, to shift the cartridge belt 40 about one position.

By virtue of particular configuration of the elastic returning bush 7, during the normal power stroke, substantially little energy will be absorbed by the returning bush 7 being pressed, and thus there will be little interference with the velocity of the piston 1, so the bulk of firing energy is used for driving the



fastener 7 into base 30, while only small portion of this energy will be used for returning the piston 1 to its firing position, thus reducing the tool reflection effect and ensuring that the piston 1 will always return to its firing position, after venting the space behind its head 12. The particular wave like shape of returning bush 7, as well as, thickening the bush 7 end segments and particular position of curvature points of bush 7 ends ensures correct functioning of the tool and eliminates the elastomeric bush tendency to curl, which tendency could drive to a situation when the piston 1 could be blocked within the guiding barrel 2. Besides, the returning bush 7 does not oppose a great resistance to the piston 1 movement, so it does not brake its velocity and it does not impair the effectiveness of fastening the fasteners and does not provoke any tool reflection effect.

## Claims

1. A power actuated piston tool with piston automatic return, comprising an external barrel with a guiding barrel  
5 situated there within, a piston means mounted for reciprocation within said guiding barrel, between firing position and fastening position, a firing-pin assembly, situated at the rear end of external barrel, operatively connected therewith, and means for automatic return of piston means from its fastening position to  
10 its firing position, situated on piston shank between piston head and fastener guide, said means for automatic piston return is a one-piece elastic returning bush (7) made of elastomeric material in the shape of bellow, whose diameters both external and internal are regularly varied, creating uniformly spaced  
15 swellings and narrowings of wave like structure.

2. A power actuated piston tool, according to claim 1, wherein the walls of returning bush (7) are approximate in shape to a sinusoid, or to a stack of frusto-spherical segments, or to a stack of frusto-conical segments, or to a stack of barrel  
20 shape segments and/or other surface of revolution segments.

3. A power actuated piston tool, according to claim 1 or 2, wherein the maximal internal diameter (D4) of at least one segment of the returning bush (7) at its both ends, is of smaller size than respective diameter (D2) of the remaining segments.

25 4. A power actuated piston tool, according to claim 1 or 2, wherein the end segment walls of returning bush (7) are thicker than other segment walls.

5. A power actuated piston tool, according to claim 1 or 2, wherein the internal end surface of external segments of  
30 returning bush (7) is markedly curved outside in such a way, that the position of curvature points (71) is clearly distanced from the returning bush (7) face (72).

6. A power actuated piston tool, according to claim 1 or 2, wherein the length of the returning bush (7) is selected in such a way, that after initial blocking, the piston shank (1) end face does not reach its extreme forward position and remains at a distance from the base (30), the distance greater than the head height of fastening element (6).

7. A power actuated piston tool, according to claim 1 or 2, wherein the maximal external diameter (D1) of the returning bush (7) is smaller enough than the internal diameter of the guiding barrel (2), that after initial blocking of the returning bush (7), its external diameter still remains smaller than the internal diameter of the guiding bush (2), thus preserving the small clearance.